Concise User's Guide

November
2024

AUS Precision

AP-DOS1

Operating System

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Welcome

Welcome to the AUS Precision AP-DOS operating system. AP-DOS 1 includes features that are described later in this introduction. If this is your first time using AP-DOS, refer to the chapter "Getting Started' for information about how to use the operating system.

About Your AP-DOS Documentation

AP-DOS documentation consists of the *AUS Precision AP-DOS Concise User's Guide,* AP-DOS command line help, and several other online documents.

This guide includes information for inexperienced users and some advanced topics for users familiar with AP-DOS. AP-DOS Help is an online reference to AP-DOS commands. The reference includes information about how to type commands and their parameters and switches, notes about commands, and examples of how to use commands.

After you've connected to AP-DOS, you can display the AP-DOS Help table of contents by typing **help** at the command prompt and then pressing ENTER. You can also get information about a command by typing **help** and the name of the command at the command prompt.

When connecting to this version of AP-DOS, you will find the following text files in the directory that contains your AP-DOS files: the README.TXT file, which provides information about how AP-DOS interacts with the hardware and software, and the NETWORKS.TXT file, which provides information about making your network compatible with this version of AP-DOS.

Features of AP-DOS 1

AP-DOS has many features that will allow you control and operate your ESP32-CAM target camera from the command line environment:

- Display contents of the disk drive which shows all the files stored locally, these include configuration files, text files and images and graphics used by the internal web server. Used and available disk space is also displayed.

- Ability to get or set various camera settings during runtime, these include camera resolutions, jpeg compression, vertical flip, horizontal flip, camera clock speed and automatic exposure correction.

- Wireless configuration allows you to get or set Wi-Fi options including the channel, password, wireless network name (SSID) along with the password for the network and transmission power.

- Ability to change the CPU clock speed from 240MHz to 160MHz or even down to 80MHz. Changing the CPU clock speed can improve battery performance but might impact upon the internal system timers.

- Control of the on-board LED's, these can be turned off or on individually or as a whole group. Turning off the LED's can also assist with extending battery life of the system.

- System debug information can be enabled and displayed to the terminal. The information displayed is the serial output debug information from the firmware running on the ESP32-CAM.

- The system can also be rebooted remotely via the command line environment, this is helpful if the webserver, desktop or mobile applications stop responding to commands over those interfaces.

Conventions

This guide uses document and keyboard conventions to help you locate and identify information.

Document Conventions

To help you locate and interpret information easily, this guide uses consistent visual cues and a standard key combination format. These conventions are explained as follows

This	Represents
bold	Commands and the switches that follow them. You must type commands and their switches exactly as they appear.
italic	Placeholders that represent information you must provide. Italic type also signals a new term. An explanation precedes or follows the italicized term.
ALL CAPITALS	The names of computers, printers, directories, and files.

AUS Precision documentation uses the term *AP-DOS* to refer to the AP-DOS, Microsoft® MS-DOS and IBM® Personal Computer DOS operating systems.

Keyboard Conventions

Key combinations and key sequences appear in the following format:

Notation	Represents
KEY1+KEY2	Hold down the first key while you press the second key. For example, "Press CTRL+C" means that you press CTRL and hold it down while you press C.

CHAPTER 1

Getting Started

AUS Precision ESP32-CAM Target Camera Systems are sold with the AP-DOS operating system installed. However, if your Target Camera System doesn't have the AP-DOS 1 operating system installed or you have built your own system based off an ESP32 SoC, you will need to flash the firmware onto the chip.

Installing the Firmware - Requirements

You will require the following to install the firmware and associated data files:

- Arduino IDE - arduino-1.8.16-windows
- Install the ESP32 Boards Library - esp32 2.0.16 (by Espressif Systems)
- Install the ESP32 Data Upload Tool - ESP32FS-1.0.zip
- AUS Precision GitHub Page – Arduino Code
- A serial programming cable with jumper wires
- Optional: A ESP32-CAM Motherboard with Micro USB Connector
- Optional: A USB A to Micro B Cable for the ESP32-CAM Motherboard

Installing the Firmware - Procedure

From the Arduino IDE, open the sketch from the downloaded Arduino Code from the AUS Precision GitHub Page. Make sure the ESP32-CAM is connected to your desktop computer (either via the serial programming cable or via the USB cable from the optional ESP32-CAM Motherboard).

- Select the correct com port (Tools -> Port)
- Upload the sketch from the Arduino IDE (Sketch -> Upload)
- After this is completed, reset the board (disconnect the cable, reconnect)
- Upload the Associated Data Files (Tools -> ESP32 Sketch Data Upload)

C H A P T E R   2

AP-DOS Basics

This chapter explains the basics of using AP-DOS 1. The first section of this chapter is a tutorial. The section explains in more detail some of the concepts described in the tutorial and provides information about using AP-DOS Help.

Learning AP-DOS Basics - A Tutorial

By following the procedures in this section, you will learn how to connect to an AP-DOS session, view the contents of the root directory, delete files and execute commands to control the AUS Precision Target Camera hardware.

Connect to AP-DOS via Telnet

To connect to AP-DOS, you need to be connected to your ESP32 based target camera system's wireless network. Once connected, you will then need to open the Telnet application on your computer or mobile device. The default Telnet address for connecting to AP-DOS is 192.168.4.1.

The Command Prompt

When you first connect to the AP-DOS session, you will see some information flash by. When the information stops scrolling past, you will see the following:

C:\>

This is called the command prompt. The flashing underscore next to the command prompt is called the cursor. The cursor shows where the command you type will appear.

Typing a Command

This section explains how to type a command at the command prompt. After typing a command, you must press ENTER.

► **To type a command at the command prompt**

1. Type the following command at the command prompt (you can type the command in either uppercase or lowercase letters):   **ver**

2. Press ENTER

   The following message appears on your screen:

   AP-DOS version 1.00

   The **ver** command displays the version number of AP-DOS. If you see the message "Bad command or file name," a mistake might have been made, so try typing the command again.

Viewing the Contents of the Root Directory

In this section, you will view the contents of the root directory using the **dir** command. The **dir** command stands for "directory."

► **To view the contents of the root directory**

• Type the following command at the command prompt: **dir**
  A list similar to the following appears:

```
Volume in drive C is AP-DOS_1
Volume Serial Number is ESP32-SPIFFS
Directory of C:\

FAVICON  ICO      15,406 08-21-24   4:11p
CFG-RES  INI          16 08-21-24   4:11p
CPU      INI           5 08-21-24   4:11p
WIFIPASS INI          12 08-21-24   4:11p
WIFISSID INI          10 08-21-24   4:11p
        5 file(s)        15,449 bytes
                         93,372 bytes free
```

This is called a directory list. A directory list is a list of all the files that a directory contains. In this case, you see all the files and directories in the main or root directory of your drive.

Deleting Files

This section explains how to delete or remove a file that you no longer want on your disk. To delete a file, you will use the **del** command. The **del** command stands for "delete."

► **To delete the MISC.TXT file**

1. Delete the MISC.TXT file by typing the following at the command prompt: **del misc.txt**

2. To confirm that you deleted the file successfully, type the following at the command prompt: **dir**

   The MISC.TXT file should no longer appear in the directory list.

Viewing Files

In this section, you will view the contents of a file using the **type** command. This command outputs the contents of a file onto the screen. Only files that contain text will be output to the screen, these include .TXT and .INI files.

► **To view the contents of a file**

1. View the README.TXT file by typing the following at the command prompt: **type readme.txt**

2. The contents of the README.TXT file will then be displayed out onto the screen. If there are more than 25 lines of text to be displayed a prompt of "-- More --" will be displayed. If this is displayed, simply press ENTER to display the next 25 lines of text.

How AP-DOS Organizes Information

The preceding tutorial introduced the commands you will most often use to find and move information. It also introduced some important terms – *file*, *directory*, and *drive* that you need to understand to use AP-DOS effectively. This section provides more information about these terms and explains how AP-DOS organizes information.

Files

A file is the primary unit of storage on your system. A file enables AP-DOS to distinguish one collection of information from another. Every file has a name, which generally indicates what type of information the file contains.

The files on your system come from various sources. Some files come with AP-DOS, while others come from other applications such as a word processor. These files contain code and other information that is necessary to make your system and system applications run.

Directories

AP-DOS does not support directories with the current file system being SPIFFS. There is one main directory called the root directory. The root directory is the starting point from which all files are stored. The root directory does not have a name. Instead, it is represented by a backslash (\). When the root directory is the current directory, the command prompt appears to the following: C:\>

Drives

Just as the root directory is a group of files, a drive, which is always represented by a drive letter, is just a group of files. Drives are usually associated with a piece of hardware called a disk. A *disk* can be anything on which data is stored.

Your first drive is called drive C. The following command prompt indicates that drive C is the current drive and that the root directory, represented by a backslash (\), is the current directory: C:\>

Naming Files

Every file must have a name. The following list summarizes the rules for naming files.
File names:

- Can be up to eight characters long. In addition, you can include and extension
  up to three characters long.

- Are not case-sensitive. It does not matter whether you use uppercase or
  lowercase letters when you type them.

- Can contain only the letters A through Z, the numbers 0 through 9, and

- Cannot contain spaces, commas, backslashes, or periods (except the period
  that separates the name from the extension).

- Cannot be identical to the name of another file in the same directory.

Using Extensions

Most filenames have two parts: the name and the extension. These parts are
separated by a period. The name (before the period) can be up to eight characters
long and should reflect the contents of the file. The extension (after the period)
can be up to three characters long.

The following are examples of commonly used extensions for filenames:

- .ICO, .JPG, .GIF
  These extensions are commonly used in graphical applications. These files
  exist on the AP-DOS file system and are accessed by the webserver running
  on the target camera system.

- .INI
  This extension is used for files that contain configuration information.

- .TXT
  This extension is commonly used for unformatted text files.

Many applications name files using an extension that is unique to that application
and might only be able to be read by that application.

Getting Help

There are type types of online help for AP-DOS commands: Using Online Help from the AUS Precision website which is a complete online command reference library for AP-DOS commands, including syntax, notes and examples; and Command-Line Help, which displays the syntax of a command without leaving the command line.

Using Online Help

AP-DOS Online Help provides an online reference to AP-DOS commands. You can access AP-DOS Online Help by visiting the AP-DOS web page on the AUS Precision website. From there it will display a table of contents, and you can choose a topic from it; or you can bypass the table of contents and display information about a specific command.

Using Command-Line Help

You can get information about the syntax of a command without starting an online web browser session to the AUS Precision website. This information is less detailed than the Online AP-DOS Help and appears directly at the command prompt.

► **To display the syntax of a command**

- At the command prompt, type the name of the command followed by a space and the /? Switch. For example, to view the syntax of the **dir** command, type the following at the command prompt   **dir /?**

CHAPTER 3

Accessing Your System

AP-DOS 1 has built in programs that you can use to manage and configure your target camera system. You can access AP-DOS from any Microsoft, Apple, or Android device. Additionally, there are desktop applications on these platforms that interact with the functions of AP-DOS via a graphical user interface.

Microsoft Windows

By default, Microsoft Windows does not have telnet enabled, therefore you will need to enable telnet under programs and features in Microsoft Windows version 7 and higher to connect to AP-DOS on your ESP32 based target camera system. There is also the dedicated AUS Precision Target Camera app available from the Microsoft Store along with the AUS Precision Management System (APMS).

Apple iOS

You can connect to AP-DOS via any Apple device running Apple iOS using a telnet app from the Apple App Store. Additionally, you can also install the AUS Precision Target Camera app, or AUS Precision Management System (APMS). These dedicated apps allow you to access, manage and view your ESP32 based target camera system.

Android OS

As with the Apple iOS Management, you can also use any telnet application available on the Google Play Store to connect to AP-DOS on your ESP32 based target camera system. There is also the AUS Precision Target Camera app as well as the AUS Precision Management System (APMS) available for Android OS.

CHAPTER 4

Configuring Your System

Your ESP32-CAM based target camera can be configured to specific requirements of its intended use and overall distance to target. Adjusting these settings allows for fine tuning of the system in its operating environment.

Camera Settings

Adjusting the camera settings can have an impact upon many factors, the main being the frame rate. At greater distances, the bandwidth reduces and so does the frame rate. Adjusting the resolution and picture quality can assist with this.

CPU Settings

By adjusting the CPU of the ESP32-CAM, you can improve battery runtime, however this may introduce system stability issues with internal clock timers and the system might become unstable.

LED Settings

The onboard LED lights of the ESP32-CAM motherboard can be individually controlled except for the POWER LED. Turning various LED's off will improve battery runtime.

Wireless Settings

You can adjust various wireless settings that will improve performance and transmission distance, these settings include the wireless channel as well power of the transmitted signal.

C H A P T E R   5

Command Line Reference

This chapter covers all the commands available within AP-DOS from the command line. There are many commands, some are simple, while others have detailed parameter options associated with them.

List of Available Commands

CAMERA	- Camera Configuration and management
CPU	- Setting of the CPU clock speed
DEL	- Deletion of a file
DIR	- Displays the files stored on the camera system
EXIT	- Terminates the current AP-DOS session
HELP	- Displays a list of the available commands in AP-DOS
LED	- Enable or disable onboard LED lights
REBOOT	- Reboots the ESP32-CAM target camera system
TYPE	- Displays the contents of a specified text file
VER	- Displays the current version of AP-DOS
VOL	- Displays the disk volume information
WIRELESS	- Wireless Configuration and management

CAMERA

Provides access to the camera configuration by either getting the configuration parameter for a camera feature or setting the parameter for the camera.

Syntax
CAMERA GET

> Displays the current camera configuration including resolution, camera clock speed, automatic exposure control, vertical and horizontal flip and image quality.

Syntax
CAMERA SET RES [VGA|SVGA|XGA|HD|SXGA|UXGA]

> **Parameters**
> [VGA|SVGA|XGA|HD|SXGA|UXGA]
> Sets the camera resolution. Different resolutions have different frame rates depending on wireless transmission distance and signal strength.

Syntax
CAMERA SET XCLK [8-20]

> **Parameters**
> [8-20]
> Sets the clock speed of the camera. This can improve camera framerate and picture quality, some OV2640 camera revisions might need fine tuning.

Syntax
CAMERA SET AEC2 [ON|OFF]

> **Parameters**
> [ON|OFF]
> Turns the Automatic Exposure Control on or off.

Syntax
CAMERA SET [VFLIP|HFLIP] [ON|OFF]

> **Parameters**
> [VFLIP|HFLIP] [ON|OFF]
> Flips the camera pixels horizontally ON or OFF, same for vertical.

Syntax
CAMERA SET QUALITY [10-90]

> **Parameters**
> [10-90]
> Numerical value, sets the quality of the MJPEG stream, the lower the setting, the more pixelation and degradation of the image. Lower settings will improve streaming performance at greater distances due to lower bandwidth requirements.

CPU

Provides access to set the current ESP32 CPU clock speed. By changing the CPU clock speed from the default of 240Mhz, it may cause stability issues with internal timers that the system uses to run tasks.

Syntax
CPU GET

Gets the current CPU clock speed in Mhz.

Syntax
CPU SET [240|160|80]

> **Parameters**
> [240|160|80]
> Sets the ESP32 CPU clock speed in Mhz. Can improve battery runtime but may impact upon system stability and internal timers for tasks.

DEL

Deletes a file from the file system. Enter the filename after the DEL command. No wildcards or partial filenames are supported. The full name and extension of the file must be entered. Only deletes one file at a time.

DIR

Displays the contents of the root directory. This will display a list of files, their sizes, the date and time that the file was created along with used and total free disk space.

EXIT

Exit will terminate the current Telnet session to AP-DOS.

HELP

Displays a list of all the available command for AP-DOS and a brief explanation of what each command does.

LED

Displays a list of all the available command for AP-DOS and a brief explanation of what each command does.

Syntax
LED GET

Displays the status of the onboard LED's and if they are enabled or disabled.

Syntax
LED SET [1-4] [ON|OFF]

> **Parameters**
> [1-4]
> LED Light number from top to bottom, does not include the power LED0.

> **Parameters**
> [ON|OFF]
> Sets the LED light to ON or OFF, this can assist with increasing battery runtime of the target camera system.

REBOOT

Reboots the ESP32 after 5 seconds from when the command was executed.

TYPE

Displays the output of .TXT and .INI files on the system to the screen. It is not designed for displaying files that have binary / non-text data. Enter the filename after the command. Displays 24 lines of text, prompting for more.

VER

Displays the AP-DOS version number.

VOL

Displays the ESP32 SPIFFS volume information for the disk drive.

WIRELESS

This command can be used to get the current wireless (Wi-Fi) configuration of the ESP32 and can also set various Wi-Fi settings such as transmission (TX) power along with wireless SSID name and Wireless Password for the Wi-Fi network created by the ESP32. Before changing any settings, make sure you consult your local authority on any wireless regulations.

Syntax
WIRELESS GET

Displays the current wireless configuration of the camera system including wireless channel, mode, power and password.

Syntax
WIRELESS SET CHANNEL [0-11]

Parameters
[0-11]
Sets the Wireless Channel Number from 0 to 11. Some countries restrict which wireless channels you can use across the 2.4 GHz spectrum. Changing the channel might improve performance if other channels are congested.

Syntax
WIRELESS SET MODE [LR|SR]

Parameters
[LR|SR]
The default is SR, being "Standard Range", and LR being "Long Range". This can have an impact upon overall transmission distance.

Syntax
WIRELESS SET NAME [SSID]

> **Parameters**
> [SSID]
> The SSID is the wireless network name of the ESP32-CAM target camera system. The wireless network name can only be 8 characters in length.

Syntax
WIRELESS SET PASSWORD [PASSWORD]

> **Parameters**
> [PASSWORD]
> Set the password of the wireless network. The password has a maximum length of 8 characters and can be a combination upper case or lowercase letters along with numbers. No special characters are permitted.

Syntax
WIRELESS SET POWER [1-10]

> **Parameters**
> [1-10]
> This sets the transmission (TX) power of the onboard wireless chip on the ESP32-CAM. The default is 10, being maximum power. The output power is measured in dBm. Check with your local authority on transmission power limits before adjusting this setting.

CHAPTER 6

Diagnosing and Solving Problems

Most problems can typically be resolved by rebooting or restarting all of the devices you are using including the ESP32-CAM and any client device that needs to interact with it.

Problems Connecting to AP-DOS

Prior to connecting to AP-DOS, ensure you are connected to the correct wireless network that the ESP32-CAM is broadcasting. Also ensure that the client device trying to connect does not have any firewall restrictions that may block the ports used by the system and the correct firewall profile is applied for your security requirements.

Firmware Stability Issues on the ESP32-CAM

The AP-DOS Operating System is part of the firmware loaded onto the ESP32-CAM. The firmware is regularly updated in release branches of "BETA" and "STABLE". Running older versions of the firmware might have bugs that need to be addressed, always make sure you have the latest firmware loaded onto the system. The latest firmware is available from the AUS Precision GitHub site.

Support

Support for AP-DOS 1 is provided by AUS Precision directly along with certified partners and developers. AUS Precision also offers direct support to those customers that have purchased their ESP32 based target camera systems. The support details are listed below.

Australia and New Zealand

Phone: +614 1270 1411
Website: www.ausprecision.com.au
Email: support@ausprecision.com.au

United States of America

Phone: +1 (865) 1000 1000
Website: www.ausprecision.com
Email: support@ausprecision.com

International Support

Phone: +1 (865) 1000 1000
Website: www.ausprecision.com
Email: international@ausprecision.com